

ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli - 620 024
Regulations 2007

Syllabus

B.E. AERONAUTICAL ENGINEERING

SEMESTER III

MA1201 – MATHEMATICS III

(Common to all branches)

L	T	P
3	1	0

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z –TRANSFORM AND DIFFERENCE EQUATIONS 9

Z-Transform – Elementary properties – Inverse Z-Transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-Transform.

L: 45 T: 15 Total: 60

TEXT BOOK

1. Grewal B.S., “Higher Engineering Mathematics”, Fortieth Edition, Khanna Publishers, 2007.

REFERENCES

1. Churchill R.V. and Brown J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill Book Co., 1987.
2. Veerarajan .T, “Engineering Mathematics III”, Third edition, Tata McGraw-Hill Education, 2007.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics Volume III”, S. Chand & Company ltd., 1996.

PR1201 – PRODUCTION TECHNOLOGY

L	T	P
3	0	0

(Common to Aeronautical / Automobile / Production)

UNIT I LATHE 9

Lathe – specification of a Lathe – block diagram – functions of each part – work holding devices – Various operations performed in Lathe – facing – turning – chamfering – and knurling – relative positions of tool and job – Taper turning operations (three methods) – thread cutting – thread – RH and LH – single start and multi start with application.

UNIT II SHAPER, PLANER AND SLOTTER 9

Shaper, planner and slotter – Block diagram, specification, working principles – functions of various parts – work and tool holding devices – operations carried out – quick return mechanism, mechanical and hydraulic cross feed mechanism – Comparison of shaping with slotting – simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III DRILLING 9

Drilling machines – block diagram – specifications – types – portable – bench – sensitive – radial arm – gang – multiple and upright – functions of parts – work holding devices and operations. Relative operations – reaming – boring – tapping – counter boring – counter sinking – trepanning and spot facing – Torque calculations.

UNIT IV MILLING 9

Milling machines – up and down milling – classification of milling machines – slot, Horizontal and vertical milling machines – block diagram – functions of each part – applications – Gear cutting using milling machine – Milling cutters – peripheral, face, end, T slot and form etc – Indexing mechanism – methods of indexing – direct – plain – compound and differential indexing – problems

UNIT V GRINDING 9

Grinding machines types – surface – cylindrical – centreless – block diagrams – specifications – functions of each parts – comparisons – applications – Grinding wheel – types – specifications – selection – Balancing – dressing – loading and turning of wheel – special grinding machines

Total: 45

TEXT BOOKS

1. P.C. Sharma, “A Text Book of Production Technology”, S. Chand and Company, 2003
2. W.A.J. Chapman, “Workshop Technology Part I and II”, Oxford and IBH Publishers, 1990

REFERENCES

1. R.K. Jain, “Production Technology”, Khanna Publishers, 1998
2. HMT Bangalore, “Production Technology”, Tata McGraw-Hill Publishing Company Limited, 1990
3. Hajra Choudhary et al, “Elements of Production Technology – Vol. II”, Asia Publishing House, 2001

AE1201 – AERO ENGINEERING THERMODYNAMICS

L T P
3 1 0

UNIT I BASIC THERMODYNAMICS 12

Systems – Zeroth Law – First Law – Heat and work transfer in flow and non-flow processes – Second law – Kelvin – Planck statement – Clausius statement – Concept of entropy – Clausius inequality – Entropy change in non-flow processes.

UNIT II AIR CYCLES 8

Otto – Diesel – Dual combustion and Brayton combustion cycles – Air standard efficiency – Mean effective pressure – Actual and theoretical PV diagrams of four stroke and two stroke IC Engines.

UNIT III THERMODYNAMICS OF ONE DIMENSIONAL FLUID FLOW 8

Application of Continuity and energy equations – Properties of steam – Rankine cycle – Isentropic flow of ideal gases through nozzles – Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR CONDITIONING 8

Principles of refrigeration – Air conditioning – Heat pumps – Vapour compression – Vapour absorption types – Coefficient of performance – Properties of refrigerants

UNIT V AIR COMPRESSORS 9

Classification and working principle – work of compression with and without clearance – Isothermal and Isentropic efficiency of reciprocating air compressors – multistage compression and inter-cooling – Various types of compressors (Descriptive treatment only)

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Yunus A.Cengal., “Thermodynamics an Engineering Approach”, Third Edition, Tata McGraw-Hill Co. Ltd., 2002.
2. Rathakrishnan, E., “Fundamentals of Engineering Thermodynamics”, Prentice–Hall, India, 2000.

REFERENCES

1. Nag. P.K., “Engineering Thermodynamics”, Tata McGraw–Hills Co., Ltd., Seventh Edition, 1993
2. Mayhew, A. and Rogers, B., “Engineering Thermodynamics”, E.L.B.S. Edition, Longman Green & Co. Ltd., 1990.
3. Van Wylen, G.J. and Sonntag, R.E., “Fundamentals of Classical Thermodynamics (S.I.Version)”, Second Edition, 1986.

CE1207 – FLUID MECHANICS AND MACHINERY

L T P
3 1 0

(Common to Aeronautical / Automobile / Mechanical / Production)

UNIT I BASIC CONCEPTS AND PROPERTIES 7

Fluid – definition – distinction between solid and fluid – Units and dimensions – Properties of fluids – density – specific weight – specific volume – specific gravity – temperature – viscosity – compressibility – vapour pressure – capillary and surface tension – Fluid statics: concept of fluid static pressure – absolute and gauge pressures – pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 10

Fluid Kinematics – Flow visualization – lines of flow – types of flow – velocity field and acceleration – continuity equation one and three dimensional differential forms – Equation of streamline – stream function – velocity potential function – circulation – flow net – fluid dynamics – equations of motion – Euler's equation along a streamline – Bernoulli's equation – applications – Venturi meter – Orifice meter – Pitot tube – dimensional analysis – Buckingham's π theorem – applications – similarity laws and models.

UNIT III INCOMPRESSIBLE FLUID FLOW 10

Viscous flow – Navier-Stoke's equation (Statement only) – Shear stress – pressure gradient relationship – laminar flow between parallel plates – Laminar flow through circular tubes (Hagen poiseulle's) – Hydraulic and energy gradient – flow through pipes – Darcy – Weisback's equation – pipe roughness –friction factor – Moody's diagram – minor losses – flow through pipes in series and in parallel – power transmission – Boundary layer flows – boundary layer thickness – boundary layer separation – drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES 10

Fluid machines: definition and classification – exchange of energy – Euler's equation for turbo machines – Construction of velocity vector diagrams – head and specific work – components of energy transfer – degree of reaction – Hydro turbines: definition and classifications – Pelton turbine – Francis turbine – Propeller turbine – Kaplan turbine – working principles – velocity triangles – work done – specific speed – efficiencies – performance curve for turbines.

UNIT V HYDRAULIC PUMPS 8

Pumps: definition and classifications – Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves – Reciprocating pump: classification – working principle – indicator diagram – work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Streeter V.L., and Wylie E.B., “Fluid Mechanics”, McGraw-Hill, 1983
2. Bansal R.K., “Fluid Mechanics and Hydraulics Machines”, Fifth Edition, Laxmi publications (P) Ltd, 1995

REFERENCES

1. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers, 1992
2. White F.M., “Fluid Mechanics”, Fifth Edition, Tata McGraw-Hill, 2003.
3. Ramamirtham S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, 1998.

CE1209 – SOLID MECHANICS

L T P
3 1 0

UNIT I **BASICS AND AXIAL LOADING** **10**

Stress and Strain – Hooke’s Law – Elastic constants and their relationship – Statically determinate cases – bar with uniform and varying section statically indeterminate cases – composite bar – Thermal Stresses – stresses due to freely falling weight.

UNIT II **STRESSES IN BEAMS** **10**

Shear force and bending moment diagrams for simply supported and cantilever beams – Bending stresses in straight beams – Shear Stresses in bending of beams with various cross sections – beams of uniform strength

UNIT III **DEFLECTION OF BEAMS** **10**

Double integration method – McCauley’s method – Area moment method – Conjugate beam method

UNIT IV **TORSION** **5**

Torsion of circular shafts – shear stresses and twist in solid and hollow circular shafts – closely coiled helical springs.

UNIT V **BI AXIAL STRESSES** **10**

Stresses in thin circular cylinder and spherical shell under internal pressure – volumetric Strain. Combined loading – Principal Stresses and maximum Shear Stresses – Analytical and Graphical methods

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Popov E.P, “Engineering Mechanics of Solids”, Second Edition, Pearson Education, 2007.
2. Nash William, “Strength of Materials”, TMH, 1998

REFERENCES

1. Timoshenko.S. and Young D.H., “Elements of strength materials Vol. I and Vol. II”, T. Van Nostrand Co-Inc Princeton-N.J., 1990.
2. Dym C.L. and Shames I.H., “Solid Mechanics”, 1990.

AE1202 – ELEMENTS OF AERONAUTICS

L	T	P
3	0	0

UNIT I	HISTORICAL EVALUATION	8
---------------	------------------------------	----------

Early airplanes – biplanes and monoplanes – Developments in aerodynamics – materials – structures and propulsion over the years

UNIT II	AIRCRAFT CONFIGURATIONS	5
----------------	--------------------------------	----------

Components of an airplane and their functions – Different types of flight vehicles – classifications – Conventional control – Powered control – Basic instruments for flying – Typical systems for control actuation

UNIT III	INTRODUCTION TO PRINCIPLES OF FLIGHT	10
-----------------	---	-----------

Physical properties and structure of the atmosphere – Temperature – pressure and altitude relationships – Evolution of lift – drag and moment – Aero-foils – Mach number – Maneuvers.

UNIT IV	INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS	12
----------------	--	-----------

General types of construction – Monocoque – semi – monocoque and geodesic construction – Typical wing and fuselage structure – Metallic and non – metallic materials – Use of aluminium alloy – titanium – stainless steel and composite materials.

UNIT V	POWER PLANTS USED IN AIRPLANES	10
---------------	---------------------------------------	-----------

Basic ideas about piston – turboprop and jet engines – Use of propeller and jets for thrust production. Comparative merits – Principles of operation of rocket – types of rockets and typical applications – Exploration into space.

Total: 45

TEXT BOOK

1. Anderson, J.D., “Introduction to Flight”, McGraw-Hill, 1995.

REFERENCE

1. Kermode, A.C., “Flight without Formulae”, McGraw-Hill, 1997.

LIST OF EXPERIMENTS

1. Performance test on a Computerized IC Engine Test Rig
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of the viscosity coefficient of a given liquid
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air – conditioning test rig
8. Study of a Gas Turbine Engine.
9. Determination of Conductive Heat Transfer Coefficient.
10. Determination of Thermal Resistance of a Composite wall.

Total: 60

CE1208 – FLUID MECHANICS AND MACHINERY LABORATORY

L	T	P
0	0	3

LIST OF EXPERIMENTS

1. Calibration of venturimeter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses.
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Performance test on piston wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

Total: 45

CE1213 – STRENGTH OF MATERIALS LABORATORY

L	T	P
0	0	3

LIST OF EXPERIMENTS

1. Hardness test – a) Vickers b) Brinell c) Rockwell d) Shore
2. Tension test
3. Torsion test
4. Impact test – a) Izod b) Charpy
5. Fatigue test – a) Reverse plate bending b) Rotating Beam
6. Testing of springs
7. Block Compression Test

Total: 45

SEMESTER IV

MA1251 – NUMERICAL METHODS

(Common to Aeronautical / Automobile / Mechanical / Production)

L T P
3 1 0

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Linear interpolation methods (method of false position) – Newton's method – Solution of linear system by Gaussian elimination and Gauss – Jordan methods – iterative methods: Gauss Jacobi and Gauss-Seidel methods – Inverse of a matrix by Gauss–Jordan method – Eigen value of a matrix by power method

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step Methods: Taylor Series method – Euler's method – Modified and Improved Euler's method – Fourth order Runge-Kutta method for solving first and second order equations – Multi-step methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by implicit and explicit methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

L: 45 T: 15 Total: 60

TEXT BOOK

1. C.F. Gerald and P.O. Wheatley "Applied Numerical Analysis", Sixth Edition, Pearson Education, 2005.

REFERENCES

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering Computation" Fourth Edition, New Age International Publishers, 2003.
2. M.K. Venkatraman, 'Numerical Methods', National Publication Company, 1991.
3. P. Kandasamy, K. Thilakavthy and K. Gunavathy, "Numerical Methods", Second Edition, S.Chand & Co., 2003.

AE1251 – AERODYNAMICS I

L	T	P
3	0	0

UNIT I	REVIEW OF BASIC FLUID MECHANICS	4
---------------	--	----------

Continuity – Momentum and energy equations.

UNIT II	TWO DIMENSIONAL FLOWS	12
----------------	------------------------------	-----------

Basic flows – Source – Sink – Free and Forced vortex – uniform parallel flow – Their combinations – Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows – Kutta Joukowski's theorem

UNIT III	CONFORMAL TRANSFORMATION	10
-----------------	---------------------------------	-----------

Joukowski transformation and its application to fluid flow problems – Kutta condition – Blasius theorem.

UNIT IV	AIRFOIL AND WING THEORY	12
----------------	--------------------------------	-----------

Joukowski, Karman – Trefftz – Profiles – Thin aerofoil theory and its applications – Vortex line – Horse shoe vortex – Biot and Savart law – Lifting line theory and its limitations.

UNIT V	VISCOUS FLOW	7
---------------	---------------------	----------

Newton's law of viscosity – Boundary Layer – Navier-Stokes equation – displacement – Momentum thickness – Flow over a flat plate – Blasius solution

Total: 45

TEXT BOOK

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., 1985.

REFERENCES

1. Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., 1989.
2. Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985.
3. Clancey, L.J., "Aerodynamics", Pitman, 1986.

AE1252 – AIRCRAFT SYSTEMS AND INSTRUMENTATIONS

L T P
3 0 0

UNIT I AIRPLANE CONTROL SYSTEMS 15

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push, Pull rod system – flexible push full rod system – Components – Modern control systems – Digital fly by wire systems – Auto pilot system active control Technology – Communication and Navigation systems Instrument landing systems – VOR – CCV case studies.

UNIT II AIRCRAFT SYSTEMS 7

Hydraulic systems – Study of typical workable system – components – Hydraulic system controllers – Modes of operation – Pneumatic systems – Advantages – Working principles – Typical Air pressure system – Brake system – Typical Pneumatic power system – Components – Landing Gear systems – Classification – Shock absorbers – Retractive mechanism.

UNIT III ENGINE SYSTEMS 8

Fuel systems for Piston and jet engines – Components of multi engines – lubricating systems for piston and jet engines – Starting and Ignition systems – Typical examples for piston and jet engines

UNIT IV AUXILLIARY SYSTEM 8

Basic Air cycle systems – Vapour Cycle systems – Boost – Strap air cycle system – Evaporative vapour cycle systems – Evaporative air cycle systems – Oxygen systems – Fire protection systems, Deicing and anti icing systems.

UNIT V AIRCRAFT INSTRUMENTS 7

Flight Instruments and Navigation Instruments – Gyroscope – Accelerometers, Air speed Indicators – TAS – EAS – Mach Meters – Altimeters – Principles and operation – Study of various types of engine instruments – Tachometers – Temperature gauges – Pressure gauges – Operation and Principles.

Total: 45

TEXT BOOKS

1. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw – Hill, 1993.
2. “General Hand Books of Airframe and Power-plant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, 1995.

REFERENCES

1. Mekinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.
2. Pallet, E.H.J., “Aircraft Instruments & Principles”, Pitman & Co., 1993.
3. Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.

ME1255 – MECHANICS OF MACHINES

L T P
3 1 0

(Common to Aeronautical / Automobile / Production)

UNIT I MECHANISMS 9

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom – Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION 9

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives – Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS 9

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound and epicyclic – Determination of speed and torque – Cams – Types of cams – Design of profiles – Knife edged – flat faced and roller ended followers with and without offsets for various types of follower motions

UNIT IV BALANCING 9

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses – primary balancing and concepts of secondary balancing – Single and multi cylinder engines – Balancing of radial V engine – direct and reverse crank method

UNIT V VIBRATION 9

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co, 2004
2. Sadhu Singh, “Theory of Machines”, Second Edition, Pearson Education, 2006.

REFERENCES

1. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, 2002
2. Rao, J.S and Dukkupati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 1992.
3. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989
4. Gosh, A and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 1989.

AE1253 – AIRCRAFT STRUCTURES I

L	T	P
3	1	0

UNIT I	STATICALLY DETERMINATE STRUCTURES	10
---------------	--	-----------

Analysis of plane truss – Method of joints – 3D Truss – Plane frames

UNIT II	STATICALLY INDETERMINATE STRUCTURES	10
----------------	--	-----------

Composite beam – Clapeyron's Three Moment Equation – Moment Distribution Method.

UNIT III	ENERGY METHODS	10
-----------------	-----------------------	-----------

Strain Energy due to axial, bending and Torsional loads – Castigliano's theorem – Maxwell's Reciprocal theorem – Unit load method – application to beams, trusses, frames, rings etc.

UNIT IV	COLUMNS	10
----------------	----------------	-----------

Columns with various end conditions – Euler's Column curve – Rankine's formula – Column with initial curvature – Eccentric loading – South well plot – Beam column.

UNIT V	FAILURE THEORY	5
---------------	-----------------------	----------

Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

L: 45 T:15 Total: 60

TEXT BOOK

1. Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.

REFERENCE

1. Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, 1990.

EE1262 – CONTROL ENGINEERING

L	T	P
3	0	0

UNIT I INTRODUCTION 6

Historical review – Simple pneumatic – hydraulic and thermal systems – Series and parallel systems – Analogies – Mechanical and electrical components – Development of flight control systems.

UNIT II OPEN AND CLOSED LOOP SYSTEMS 6

Feedback control systems – Block diagram representation of control systems – Reduction of block diagrams – Output to input ratios – Signal flow graph.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS 10

Laplace transformation – Response of systems to different inputs viz – Step input – impulse – ramp – parabolic and sinusoidal inputs – Time response of first and second order systems – steady state errors and error constants of unity feedback circuit

UNIT IV CONCEPT OF STABILITY 15

Necessary and sufficient conditions – Routh-Hurwitz criteria of stability – Root locus and Bode techniques – Concept and construction – frequency response

UNIT V SAMPLED DATA SYSTEMS 8

Introduction to digital control system – Digital Controllers and Digital PID Controllers

Total: 45

TEXT BOOKS

1. OGATO, “Modern Control Engineering”, Prentice-Hall of India Pvt. Ltd., 1998.
2. GOPAL. M., “Control Systems, Principles and Design”, Tata McGraw-Hill Publication, 2000.

REFERENCES

1. Azzo, J.J.D. and C.H. Houpis, “Feed back control system analysis and synthesis”, Third Edition, McGraw-Hill International, 1998.
2. Kuo, B.C., “Automatic control systems”, Prentice-Hall of India Pvt. Ltd., 1998.
3. Houpis, C.H. and Lamont, G.B., “Digital Control Systems”, McGraw-Hill Book Co., 1995.

LIST OF EXPERIMENTS

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoils.
4. Pressure distribution over cambered airfoils & thin airfoils
5. Force measurement using wind tunnel balance.
6. Flow over a flat plate at different angles of incidence
7. Flow visualization studies in low speed flows over cylinders
8. Flow visualization studies in low speed flows over airfoil with different angle of incidence
9. Calibration of supersonic wind tunnel.
10. Supersonic flow visualization with Schlieren system.

Total: 45

LIST OF EXPERIMENTS

1. Determination of Young's modulus of steel using mechanical extensometers.
2. Determination of Young's modulus of aluminum using electrical extensometers
3. Determination of fracture strength and fracture pattern of ductile materials
4. Determination of fracture strength and fracture pattern of brittle materials
5. Stress Strain curve for various engineering materials.
6. Deflection of beams with various end conditions.
7. Verification of Maxwell's Reciprocal theorem & principle of superposition
8. Column – Testing
9. South – well's plot.
10. Riveted Joints.

Total: 45

AE1256 – DESIGN AND DRAFTING

L	T	P
0	0	3

LIST OF EXERCISES

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

Total: 45

SEMESTER V

HA1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P
3	0	0

UNIT I IMPORTANCE OF ENVIRONMENTAL STUDIES 9

Definition – Scope and Importance – Need for Public Awareness – Forest Resources – Water Resources – Mineral Resources – Land Resources – Energy Resources – Food Resources – Equitable use of Resources for Sustainable Lifestyles.

UNIT II ECOSYSTEMS AND BIO DIVERSITY 9

Concept of Ecosystem – Structure and Function of an Ecosystem – Energy Flow in the Ecosystem – Food Chains – Food Webs – Ecological Pyramids – Definition of Bio-Diversity – Bio Geographical Classification in India – Value of Bio Diversity – Bio Diversity at Global – National and Local Levels – India as a Mega Diversity Nation – Hot Spots of Bio Diversity – Threats to Bio Diversity – Conservation of Bio Diversity.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – Causes and Effects of Environmental Pollution – Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Hazards – Solid Waste Management – Societal Role in Pollution Prevention – Environmental Disasters and Management.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to Sustainable Development – Concept of Conservation – Water and Energy Conservation – Rain Water Harvesting – Climate Change – Global Warming – Acid Rain – Ozone Layer Depletion – Nuclear Accidents and Holocaust – Environmental Protection Act – Issues Involved in Enforcement of Environmental Legislation – Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population Growth – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of IT in Environment and Human Health

Total: 45

TEXT BOOKS

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Second Edition, Pearson Education, 2004.
2. Miller T.G. Jr., “Environmental Science Working With the Earth”, Thomson Learning, 2001.
3. Trivedi R.K and P.K. Goel, “Introduction to Air Pollution”, Techno - Science Publications, 1998.

REFERENCES

1. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing, 2006.
2. Trivedi R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Environ Media, 1998.
3. Cunningham W.P. Copper and T.H. Gorhani, “Environmental Encyclopedia”, Jaico Publication, 2001.

AE1301 – FLIGHT DYNAMICS

L	T	P
3	0	0
		7

UNIT I DRAG ON THE AIRPLANE

International Standard Atmosphere - Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polars of vehicles from low speed to high speeds - Variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets - Power available and power required curves.

UNIT II AIRCRAFT PERFORMANCE 10

Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor - Limitations of pull up and push over - V-n diagram and load factor.

UNIT III STATIC LONGITUDINAL STABILITY 10

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.

UNIT IV LATERAL AND DIRECTIONAL STABILITY 8

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

UNIT V DYNAMIC STABILITY 10

Dynamic longitudinal stability: Equations of motion - Stability derivatives - Characteristic equation of stick fixed case - Modes and stability criterion - Effect of freeing-the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

Total: 45

TEXT BOOK

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, 1988.

REFERENCES

1. Etkin, B., "Dynamics of Flight Stability and Control", Second Edition, John Wiley, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero Dynamics", Third Edition, Issac Pitman, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.

EC1311 – MICROPROCESSORS AND APPLICATIONS

L T P
3 0 0

UNIT I SEMICONDUCTOR DEVICES 12

PN Junction diodes – Zenor Diodes – Tunnels Diodes- Thermistors – Transistors – FET and MOSFET – Silicon Controlled Rectifiers And Triacs – Their Applications – Half Wave and Full Wave Rectifiers – Filters – Ripple Factor – Zenor Regulators and AC Voltage Regulators – Principles and Types of Transistor Amplifiers – RC Coupled, Transformer Coupled, Direct Coupled – Multistage, FET and Power Amplifiers.

UNIT II LINEAR AND DIGITAL ICS 10

IC Technology – Elements of Fabrication of Linear and Digital IC's – D/A and A/D Converters – Comparison Between Analog and Digital Systems – Number Representation – Binary, Octal and Hexadecimal Number Systems – Logic Families and Logic Gates – Flip – Flops – Multi Vibrations Using IC's – Half and full Adder – Registers – Counters – Multiplexers- Demultiplexers – Decoders – Encoders.

UNIT III MICROPROCESSORS 10

Block Diagram of Microprocessors – Architecture of Intel 8085 – Importance of Data, Address and Control Buses – Instruction Formats – Addressing Modes and Types of Intel 8085 – Instruction Set For 8085 – Development of Simple Language Assembly Programs – Architecture and Functioning of Processors like Z80, M6800 and Intel Family of 80 X86 Processors.

UNIT IV MICROPROCESSOR MEMORY DEVICES 8

RAM, ROM, EPROM – magnetic Bubble Memory – Floppy and Hard Disc – Interfacing of Memory Chips – CRT Terminals – Printers, Keyboards and their Interfacing – Parallel and Series Communication – Synchronous and Asynchronous Data Transfer – DMA Data Transfer.

UNIT V APPLICATIONS 5

Microprocessor Applications in aerospace – Case study.

Total: 45

TEXT BOOKS

1. “Computer principles of architecture”, Fourth Edition, Tata McGraw-Hill, 2002.
2. Goankar. R.S., “Microprocessors, Programming to Architecture 8085”, Fifth Edition, Penram International publishing PVT Ltd, 2002
3. V.K. Mehta, “Principles of Electronics”, Second Edition, S. Chand & Co, 2002

REFERENCES

1. Malvino A.P. Leach, D.P., “Digital Principles & Applications”, Tata McGraw– Hill, 1990.
2. Goankar R.S., “Microprocessors Architecture. Programming and Applications”, Wiley Eastern, 1992.
3. Ajit Pal., “Microprocessors”, Revised Edition, Tata McGraw-Hill, 1995.
4. Douglas, Hall, “Microprocessors and Interfacing”, Revised Edition, Tata McGraw–Hill, 1990.
5. Mathur A.P., “Introduction to Microprocessors”, Revised Edition, Tata McGraw–Hill, 1995.

AE1305 – AIRCRAFT STRUCTURES LABORATORY II

L T P
0 0 3

LIST OF EXPERIMENTS

1. Unsymmetrical bending of beams
2. Shear centre location for open sections
3. Shear centre location for closed sections
4. Constant strength beam
5. Flexibility matrix for cantilever beam
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photoelastic techniques
9. Vibrations of beams
10. Wagner beam – Tension field beam

Total: 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No.	Name of the Equipment	Qty	Experiments Number
1	Beam Test set –up	2	1, 2, 3,4
2	Unsymmetrical sections like ‘Z’ sections	2	1, 2, 3
3	Channel section and angle section	2	1, 2, 3
4	Dial gauges	12	1, 2, 3
5	Weights 1Kg	10	1, 2, 3
6	Weights 2 Kg	10	1, 2, 3
7	Beam Test Set – up	2	3, 4
8	Strain indicator and strain gauges	One set	4,5,6
9	Photo – elastic apparatus	1	7,8
10	Amplifier	2	9
11	Exciter	2	9
12	Pick – up	2	9
13	Oscilloscope	2	9
14	Wagner beam	1	10
15.	Hydraulic Jack	1	10

AE1306 – AIRCRAFT STRUCTURES REPAIR LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

1. Aircraft wood gluing
2. Welded patch repair by TIG, MIG, PLASMA ARC.
3. Welded patch repair by MIG
4. Welded patch repair by plasma Arc
5. Fabric Patch repair
6. Riveted patch repairs.
7. Repair of composites
8. Repair of Sandwich panels.
9. Sheet metal forming.
10. Control cable inspection and repair.

Total: 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No.	Name of the Equipment	Quantity	Experiment No.
1	Shear cutter pedestal type	1	4,6
2	Drilling Machine	1	4,5,6
3	Bench Vices	1	1,5,6
4	Radius Bend bars	1	2,3
5	Pipe Flaring Tools	1	9
6	Carbide Gas Plant	1	4
7	MIG Weld Plant	1	3
8	TIG Weld Plant	1	2

ME1307 – CAD / CAM LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

1. Scaling, rotation, translation, editing, dimensioning – Typical CAD command structure.
2. Wire frame modeling – surface modeling
3. Solid Modeling
4. Taper Turning – Straight Interpolation
5. Taper Turning – Circular Interpolation
6. Incremental programme G 90 operation.
7. Mirroring.
8. Incremental Programme G 91 operation
9. Absolute Programme G 90 operation
10. Absolute Programme G 91 operation

Total: 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1	Computer nodes	30	1 to 7
2	Pro-E – 2001, 2002 – CAD Packages	30 licenses	1 to 7
3	ANSYS- 7, STAR – CD	30 licenses	1 to 7
4	UPS	1	1 to 7

SEMESTER VI

MG1351 – PRINCIPLES OF MANAGEMENT

(Common to all Branches)

L T P
3 0 0

UNIT I HISTORICAL DEVELOPMENT 9

Definition of management – Science or Art – Management and administration – Development of management thought – Contribution of Taylor and Fayol – Functions of management – Types of business organisation.

UNIT II PLANNING 9

Nature and purpose – Steps involved in planning – Objectives – Setting objectives – Process of managing by objectives – Strategies, policies and planning premises – Forecasting – Decision-making.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Structure and process – Departmentation by different strategies – Line and staff authority – Benefits and limitations – De-centralization and delegation of authority – Staffing – Selection process – Techniques – HRD – Managerial effectiveness.

UNIT IV DIRECTING 9

Scope – Human factors – Creativity and innovation – Harmonizing objectives – Leadership – Types of leadership motivation – Hierarchy of needs – Motivation theories – Motivational techniques – Job enrichment – Communication – Process of communication – Barriers and breakdown – Effective communication – Electronic media in communication.

UNIT V CONTROLLING 9

System and process of controlling – Requirements for effective control – The Budget as control technique – Information technology in controlling – Use of computers in handling the information – Productivity – Problems and management – Control of overall performance – Direct and preventive control – Reporting – The Global environment – Globalization and liberalization – International management and global theory of management.

Total: 45

TEXT BOOKS

1. Kooritz, H. and Weihrich, H., "Essentials of Management", Tata McGraw-Hill, 1998.
2. Massie, J.L., "Essentials of Management", 4th Edition, Prentice Hall of India, 2003.

REFERENCES

1. Tripathy, P.C. and Reddy P.N., "Principles of Management", Tata McGraw-Hill, 1999.
2. David, D. and Robbin Stephen, A., "Personnel and Human Resources Management", Prentice Hall of India, 1996.
3. Stomer, J.A.F., Freeman R. E. and Gilbert, D.R., "Management", 6th Edition, Pearson Education, 2004.

AE1351 – PROPULSION II

L T P
3 0 0

UNIT I AIRCRAFT GAS TURBINES 12

Impulse and reaction blading of gas turbines – Velocity triangles and power output – Elementary theory – Vortex theory – Choice of blade profile, pitch and chord – Estimation of stage performance – Limiting factors in gas turbine design – Overall turbine performance – Methods of blade cooling – Matching of turbine and compressor – Numerical problems.

UNIT II RAMJET PROPULSION 10

Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram-rocket – Numerical problems.

UNIT III FUNDAMENTALS OF ROCKET PROPULSION 8

Operating principle – Specific impulse of a rocket – Internal ballistics – Rocket nozzle classification – Rocket performance considerations – Numerical problems.

UNIT IV CHEMICAL ROCKETS 10

Solid propellant rockets – Selection criteria of solid propellants – Important hardware components of solid rockets – Propellant grain design considerations – Liquid propellant rockets – Selection of liquid propellants – Thrust control in liquid rockets – Cooling in liquid rockets – Limitations of hybrid rockets – Relative advantages of liquid rockets over solid rockets- Numerical Problems.

UNIT V ADVANTAGES OF PROPULSION TECHNIQUES 5

Electric rocket propulsion – Ion propulsion techniques – Nuclear rocket – Types – Solar sail- Preliminary Concepts in nozzleless propulsion.

Total: 45

TEXT BOOKS

1. Sutton, G.P., “Rocket Propulsion Elements”, 5th Edition, John Wiley and Sons Inc., 1993.
2. Hill, P.G. and Peterson, C.R., “Mechanics and Thermodynamics of Propulsion”, Addison–Wesley Longman INC, 1999.

REFERENCES

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Longman Co., ELBS Edition, 1989.
2. Gorden, C.V., “Aero thermodynamics of Gas Turbine and Rocket Propulsion”, AIAA Education Series, 1989.
3. Mathur, M. and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, 1988.

ME1361 – HEAT TRANSFER

L T P
3 0 0

UNIT I HEAT CONDUCTION 11

Basic modes of heat transfer – One dimensional steady state heat conduction – Composite medium – Critical thickness – Effect of variation of thermal conductivity – Extended surfaces – unsteady state.

Heat Conduction: Lumped system analysis – Heat Transfer in semi infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.

UNIT II CONVECTIVE HEAT TRANSFER 10

Introduction – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe – Empirical relations, application of numerical techniques in problem solving.

UNIT III RADIATIVE HEAT TRANSFER 8

Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields.

UNIT IV HEAT EXCHANGERS 8

Classification – Temperature distribution – Overall heat transfer coefficient – Heat exchange analysis – LMTD method and E-NTU method.

UNIT V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING 8

High-Speed flow heat transfer – Heat transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer.

Total: 45

TEXT BOOKS

1. Yunus, A.C., “Heat Transfer – A Practical Approach”, 2nd Edition, Tata McGraw-Hill, 2002.
2. Incropera, F.P. and Dewitt, D.P., “Introduction to Heat Transfer”, John Wiley and Sons, 2002.

REFERENCES

1. Lienhard, J.H., “A Heat Transfer Text Book”, Prentice Hall Inc., 1981.
2. Holman, J.P., “Heat Transfer”, 6th Edition, McGraw-Hill Book Co., Inc., 1991.
3. Sachdeva, S.C., “Fundamentals of Engineering Heat and Mass Transfer”, Wiley Eastern Ltd., 1981.
4. Mathur, M. and Sharma, R.P., “Gas Turbine and Jet and Rocket Propulsion”, Standard Publishers, 1988.

AE1352 – EXPERIMENTAL STRESS ANALYSIS

	L	T	P
UNIT I MEASUREMENTS	3	0	0
Principles of measurements – Accuracy – Sensitivity and range of measurements.			4
UNIT II EXTENSOMETERS			6
Mechanical, optical, acoustical and electrical extensometers and their uses – Advantages – Disadvantages.			
UNIT III ELECTRICAL RESISTANCE STRAIN GAUGES			10
Principle of operation and requirements – Types and their uses – Materials for strain gauge – Calibration and temperature compensation, cross sensitivity, rosette analysis, wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.			
UNIT IV PHOTOELASTICITY			10
Two dimensional photo elasticity – Concept of light – Photoelastic effects, stress optic law – Interpretation of fringe pattern – Compensation and separation techniques – Photo elastic materials – Introduction to three dimensional photo elasticity.			
UNIT V NON – DESTRUCTIVE TESTING			15
Fundamentals of NDT – Radiography, ultrasonic, magnetic particle inspection – Fluorescent penetrant technique, eddy current testing, acoustic emission technique – Fundamentals of brittle coating methods – Introduction to Moiré techniques – Holography, ultrasonic C- Scan, thermograph, fiber - optic Sensors.			

Total: 45

TEXT BOOK

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant, B. and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, 1984.

REFERENCES

1. Dally, J.W. and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., 1998.
2. Hetenyi, M., “Hand Book of Experimental Stress Analysis”, John Wiley and Sons Inc., 1972.
3. Pollock, A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Chapman and Hall, 1993.

AE1353 – HIGH TEMPERATURE MATERIALS

L	T	P
3	0	0

UNIT I CREEP **9**

Factors influencing functional life of components at elevated temperatures – Definition of creep curve – Various stages of creep – Metallurgical factors influencing various stages – Effect of stress, temperature and strain rate – Introduction to creep map.

UNIT II DESIGN FOR CREEP RESISTANCE **9**

Design of transient creep time – Hardening, strain hardening, expressions of rupture life of creep – Ductile and brittle materials – Monkman-Grant relationship.

UNIT III FRACTURE **9**

Various types of fracture – Brittle to ductile from low temperature to high temperature – Cleavage fracture – Ductile fracture due to micro void coalescence – Diffusion controlled void growth – Fracture maps for different alloys and oxides.

UNIT IV OXIDATION AND HOT CORROSION **9**

Oxidation – Pilling – Bedworth ratio – Kinetic laws of oxidation – Defect structure and control of oxidation by alloy additions – Hot gas corrosion deposit – Modified hot gas corrosion – Fluxing mechanisms – Effect of alloying elements on hot corrosion – Interaction of hot corrosion and creep – Methods of combat hot corrosion.

UNIT V SUPERALLOYS AND OTHER MATERIALS **9**

Iron base – Nickel base and Cobalt base super alloys – Composition control – Solid solution strengthening – Precipitation hardening by gamma prime – Grain boundary strengthening – TCP phase – Embrittlement – Solidification of single crystals – Intermetallics – High temperature ceramics.

Total: 45

TEXT BOOKS

1. Raj, R., “Flow and Fracture at Elevated Temperatures”, American Society for Metals, 1985.
2. Hertzberg, R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4th Edition, John Wiley, 1996.
3. Courtney, T.H., “Mechanical Behavior of Materials”, McGraw-Hill, 1990.

REFERENCES

1. Boyle, J.T. and Spencer, J., “Stress Analysis for Creep”, Butterworths, 1983.
2. Bressers, J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.
3. McLean, D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, 1985.

AE1354 – AIRCRAFT DESIGN PROJECT I

L T P
0 0 3

LIST OF EXPERIMENTS

1. Comparative configuration study of different types of airplanes
2. Comparative study on specification and performance details of aircraft
3. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

Total: 60

LIST OF EQUIPMENTS (for a batch of 30 students)

S.No.	Name of the Equipment	Quantity	Experiments Number
1	Engineering Drawing Board	30 Nos.	3
2	Engineering Drawing Instruments	30 Nos.	3

AE1355 – PROPULSION LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)
3. Study of forced convective heat transfer over a flat plate.
4. Study of free convective heat transfer over a flat plate
5. Cascade testing of a model of axial compressor blade row.
6. Study of performance of a propeller.
7. Determination of heat of combustion of aviation fuel.
8. Combustion performance studies in a jet engine combustion chamber.
9. Study of free jet.
10. Study of wall jet.

Total: 60

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No	Equipments	Qty	Experiments No.
1	Piston engines	2 Nos.	1
2	Jet Engine /Engine model	1 No.	2
3	Forced Convective apparatus	1 No.	3
4	Free Convective apparatus	1 No.	4
5	Axial compressor blade row model with pressure tapping	1 No.	5
6	Watertube manometers (20 tubes)	2 Nos.	5,8,9
7	Subsonic wind tunnel	1 No.	4
8	Propeller model static and total pressure probes	4 Nos.	8,9
9	2-D travers in mechanism	2 Nos.	8
10.	Freejet test setup	1 No.	9
11.	Aluminium plates with deflection mechanisms	1 No.	10

AE1356 – AERO ENGINE REPAIR AND MAINTENANCE LABORATORY

L T P
0 0 3

1. Stripping of a piston engine
2. Engine (Piston Engine) - cleaning, visual inspection, NDT checks.
3. Piston Engine Components - dimensional checks.
4. Piston – Engine reassembly.
5. Propeller Pitch Setting
6. Stripping of a jet engine
7. Jet Engine – identification of components and defects.
8. Jet Engine – NDT checks and dimensional checks
9. Jet Engine – reassembly.
10. Engine starting procedures.

Total: 60

LIST OF EQUIPMENTS (for a batch of 30 students)

S.No	Equipments	Qty	Experiments No.
1	Piston Engines	2 No.	1,2,3,4
2	Jet Aero Engines	2 No.	6,7,8,9
3	Propeller pitch setting stand	1 No.	5
4	Aircraft with serviceable stand	1 No.	1 to 10
5	Precision instruments (Vernier Caliper, Micro meter, Cylinder bore gauge, depth gauge, Bevel Protector and DTI)	2 each	3,5,8
6	NDT Equipments (Defectoscope, Dyepenetrant method, Hot oil Chalk Method)	1 each	2,8

ELECTIVE I

AE1001 – THEORY OF ELASTICITY

L	T	P
3	0	0

UNIT I ASSUMPTIONS IN ELASTICITY 4

Definitions – Notations and sign conventions for stress and strain – Equations of equilibrium.

UNIT II BASIC EQUATIONS OF ELASTICITY 15

Strain – Displacement relations – Stress – Strain relations – Lamé’s constant – Cubical dilation, Compressibility of material – Bulk modulus, shear modulus – Compatibility equations for stresses and strains – Principal stresses and principal strains – Mohr’s circle – Saint Venant’s principle.

UNIT III PLANE STRESS AND PLANE STRAIN PROBLEMS 8

Airy’s stress function – Bi-harmonic equations – Polynomial solutions – Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams, etc.,

UNIT IV POLAR COORDINATES 10

Equations of equilibrium, Strain displacement relations, Stress – Strain relations – Axisymmetric problems – Kirsch – Michell’s – Boussinesque problems.

UNIT V TORSION 8

Navier’s theory – St. Venant’s theory – Prandtl’s theory on torsion – The semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections.

Total: 45

TEXT BOOK

1. Timoshenko, S. and Goodier, T.N., “Theory of Elasticity”, McGraw Hill Ltd., 1990.

REFERENCES

1. Volterra, E. and Caines, J.H., “Advanced Strength of Materials”, Prentice Hall, 1991.
2. Wng, C.T., “Applied Elasticity”, McGraw–Hill Co., 1993.
3. Sokolnikoff, I.S., “Mathematical Theory of Elasticity”, McGraw Hill, 1978.

AE1002 – SPACE MECHANICS

L	T	P
3	0	0

UNIT I BASIC CONCEPTS 4

The solar system – Reference frames and coordinate systems – The celestial sphere – The ecliptic – Motion of vernal equinox – Sidereal time – Solar time – Standard time – The earth's atmosphere.

UNIT II THE GENERAL N-BODY PROBLEM 10

The many body problem – Lagrange – Jacobian identity – The circular restricted three body problem – Libration points- Relative motion in the N-body problem – Two-Body problem – Satellite orbits – Relations between position and time – Orbital elements.

UNIT III SATELLITE INJECTION AND SATELLITE ORBIT PERTURBATIONS 12

General aspects of satellite injections – Satellite orbit transfer – Various cases – Orbit deviations due to injection errors – Special and general perturbations – Cowell's method – Encke's method – Method of variations of orbital elements – General perturbations approach.

UNIT IV INTERPLANETARY TRAJECTORIES 6

Two dimensional interplanetary trajectories – Fast interplanetary trajectories – Three dimensional interplanetary trajectories – Launch of interplanetary spacecraft – Trajectory about the target planet.

UNIT V BALLISTIC MISSILE TRAJECTORIES AND MATERIALS 13

The boost phase – The Ballistic phase – Trajectory geometry – Optimal flights – Time of flight – re-entry phase – The position of the impact point – Influence coefficients – Space environment – Peculiarities – Effect of space environment on the selection of spacecraft material.

Total: 45

TEXT BOOK

1. Cornelisse, J.W., "Rocket Propulsion and Space Dynamic", W.H. Freeman and Co., 1984.

REFERENCES

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley, 1993.
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1979.
3. Parker, E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982.

**AE1003 – AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE
PRACTICES**

L T P
3 0 0

UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 10

Mooring, jacking, levelling and towing operations – Preparation – Equipment – Precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power units.

UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS 8

Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance.

UNIT III MAINTENANCE OF SAFETY 5

Shop safety – Environmental cleanliness – Precautions.

UNIT IV INSPECTION 10

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data Sheets – ATA specifications.

UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEMS PROCESSES 12

Hand tools – Precision instruments – Special tools and equipments in an airplane maintenance shop – Identification terminology – Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws etc.,) – American and British systems of specifications – Threads, gears, bearings, etc., – Drills, tapes and reamers. – Identification of all types of fluid line fittings – Materials, metallic and non-metallic – Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

Total: 45

TEXT BOOK

1. Delp, K. W., “Aircraft Maintenance and Repair”, McGraw-Hill, 1993.

REFERENCES

1. A and P Mechanics, “Aircraft Hand Book”, F. A. A. Himalayan Book House, 1996.
2. A and P Mechanics, “General Hand Book”, F. A. A. Himalayan Book House, 1996.

AE1004 – AIRCRAFT RULES AND REGULATIONS

L T P
3 0 0

UNIT I C.A.R. SERIES ‘A’ – PROCEDURE FOR CIVIL AIR WORTHINESS REQUIREMENTS AND RESPONSIBILITY OPERATORS Vis-à-vis AIR WORTHINESS DIRECTORATE 8

Responsibilities of operators / owners – Procedure of CAR issue, amendments etc., – Objectives and targets of airworthiness directorate – Airworthiness regulations and safety oversight of engineering activities of operators.

C.A.R. Series ‘B’ – Issue Approval of Cockpit Check List, MEL, CDL

Deficiency list (MEL and CDL) – Preparation and use of cockpit checklist and emergency list.

UNIT II C.A.R. SERIES ‘C’ – DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING 7

Defect recording, reporting, investigation, rectification and analysis – Flight report – Reporting and rectification of defects observed on aircraft – Analytical study of in-flight readings and recordings – Maintenance control by reliability Method.

C.A.R. Series ‘D’ – Aircraft Maintenance Programmes

Reliability Programmes (Engines) – Aircraft maintenance programme and their approval – On condition maintenance of reciprocating engines – TBO – Revision programme – Maintenance of fuel and oil uplift and consumption records – Light aircraft engines – Fixing routine maintenance periods and component TBOs – Initial and revisions.

UNIT III C.A.R. SERIES ‘E’ – APPROVAL OF ORGANISATIONS 10

Approval of organizations in categories A, B, C, D, E, F, and G – Requirements of infrastructure at stations other than parent base.

C.A.R. Series ‘F’ – Air Worthiness and Continued Air Worthiness

Procedure relating to registration of aircraft – Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of certificate of airworthiness – Requirements for renewal of certificate of airworthiness.

UNIT IV C.A.R. SERIES ‘L’and’M’ 8

Issue of AME Licence – Classification and experience requirements – Mandatory modifications / inspections.

UNIT V C.A.R. SERIES ‘T’and’X’ 12

Flight testing of (Series) aircraft for issue of C of A – Flight testing of aircraft for which C of A had been previously issued –Registration Markings of aircraft – Weight and balance control of an aircraft – Provision of first aid kits and physician’s kit in an aircraft – Use furnishing materials in an aircraft – Concessions – Aircraft log books –Document to be carried on board on Indian registered aircraft – Procedure for issue of tax permit – Procedure for issue of type approval of aircraft components and equipment including instruments.

Total: 45

TEXT BOOKS

1. Anonymous, "Civil Aviation Requirements with Latest Amendment (Section 2 Airworthiness)", DGCA Publications, 2000.
2. Aeronautical Information Circulars (relating to Airworthiness), DGCA Publications, 2000.

REFERENCES

1. Anonymous, "Aircraft Manual (India) Volume", Latest Edition, The English Book Store, 17-1, Connaught Circus.
2. Advisory Circulars from DGCA 2003.

SEMESTER VII

TOTAL QUALITY MANAGEMENT

(Common to Aeronautical, Automobile, Mechanical and Production)

L T P
3 0 0

UNIT I INTRODUCTION 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept, requirements and benefits.

Total: 45

TEXT BOOKS

1. Dale H. Besterfield., “Total Quality Management”, Pearson Education, Inc. 2003.
2. James R. Evans and William M. Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western, 2002.

REFERENCES

1. Feigenbaum, A.V., “Total Quality Management”, McGraw Hill, 1991.
2. Oakland, J.S., “Total Quality Management”, Butterworth Heineman, 1989.
3. Narayana, V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
4. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

AVIONICS

L T P
3 0 0

UNIT I INTRODUCTION TO AVIONICS 6

Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon system – Typical avionics sub systems – Design and technologies.

UNIT II PRINCIPLES OF DIGITAL SYSTEMS 10

Digital computers – Microprocessors – Memories

UNIT III DIGITAL AVIONICS ARCHITECTURE 6

Avionics system architecture – Data buses MIL – STD 1553 B – ARINC 429 – ARINC 629.

UNIT IV FLIGHT DECK AND COCKPITS 8

Control and display technologies CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil cockpit and military cockpit: MFDS, HUD, MFK, HOTAS

UNIT V INTRODUCTION TO AVIONICS SYSTEMS 15

Communication systems – Navigation systems – Flight control systems – Radar electronic warfare – Utility systems reliability and maintainability – Certification.

Total: 45

TEXT BOOKS

1. Malcrno, A.P. and Leach, D.P., “Digital Principles and Application”, Tata McGraw-Hill, 1990.
2. Gaonkar, R.S., “Microprocessors Architecture – Programming and Application”, Wiley and Sons Ltd., 1990.

REFERENCES

1. Middleton, D.H., “Avionics Systems, Longman Scientific and Technical”, Longman Group, 1989.
2. Spitzer, C.R., “Digital Avionic Systems”, Prentice Hall, Englewood Cliffs, 1987.
3. Brain Kendal, “Manual of Avionics”, 3rd Edition, The English Book House, 1993.

COMPOSITE MATERIALS AND STRUCTURES

L T P
3 0 0

UNIT I STRESS STRAIN RELATION 6

Introduction – Advantages and application of composite materials – Reinforcements and matrices – Generalised Hooke's Law – Elastic constants for anisotropic, orthotropic and isotropic materials.

UNIT II METHODS OF ANALYSIS 12

Micro mechanics – Mechanics of materials approach – Elasticity approach to determine material properties – Macro mechanics – Stress-strain relations with respect to natural axis and arbitrary axis – Determination of material properties – Experimental characterization of lamina.

UNIT III LAMINATED PLATES 12

Governing differential equation for a general laminate, angle ply and cross ply laminates – Failure criteria for composites.

UNIT IV SANDWICH CONSTRUCTIONS 8

Basic design concepts of sandwich construction – Materials used for sandwich construction – Failure modes of sandwich panels.

UNIT V FABRICATION PROCESS 7

Various Open and closed mould processes – Manufacture of fibers – Types of resins and properties and applications – Netting analysis.

Total: 45

TEXT BOOKS

1. Calcote, L.R., "The Analysis of Laminated Composite Structures", Von-Nostrand Reinhold Company, 1998.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., 1985.

REFERENCES

1. Agarwal, B.D. and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and Sons. Inc., 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., 1989.

COMPUTER INTEGRATED MANUFACTURING
(Common to Aeronautical, Mechanical and Production)

L T P
3 0 0

UNIT I INTRODUCTION 8

The meaning and origin of CIM – The changing manufacturing and management scene – External communication – Islands of automation and software – Dedicated and open systems – Manufacturing automation protocol – Product related activities of a company – Marketing engineering – Production planning – Plant operations – Physical distribution – Business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology – Role of G.T. in CAD/CAM integration – Part families – Classification and coding – DCLASS and MICLASS and OPITZ coding systems – Facility design using G.T. – Benefits of G.T. – Cellular manufacturing.

Process planning – Role of process planning in CAD/CAM integration – Approaches to computer aided process planning – Variant approach and generative approaches – CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control – Phases – Factory data collection system – Automatic identification methods – Bar code technology – Automated data collection system.

FMS – Components of FMS – Types – FMS workstation – Material handling and storage systems – FMS layout – Computer control systems – Application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy – System modeling tools – IDEF models – Activity cycle diagram – CIM open system architecture (CIMOSA) – Manufacturing enterprise wheel – CIM architecture – Product data management – CIM implementation software – Communication fundamentals – Local area networks – Topology - LAN implementations – Network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems – Open system inter connection – Manufacturing automations protocol and technical office protocol (MAP /TOP)

Development of databases – Database terminology – Architecture of database systems – Data modeling and data associations – Relational data bases – Database operators – Advantages of data base and relational database.

Total: 45

TEXT BOOK

1. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 2001.
2. Yoram Koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.

REFERENCES

1. Ranky, Paul, G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
2. Roger Hanman, "Computer Intergrated Manufacturing", Addison Wesley, 1997.
3. Mikell P. Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., 1998.
4. Radhakrishnan, P., Subramanyan, S. and Raju, V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd., 2000.

AIRCRAFT DESIGN PROJECT II

L T P
0 0 3

LIST OF EXPERIMENTS

1. V-n diagram for the design study
2. Gust and maneuverability envelopes
3. Critical loading performance and final V-n graph calculation
4. Structural design study – Theory approach
5. Load estimation of wings
6. Load estimation of fuselage.
7. Balancing and Maneuvering loads on tail plane, Aileron and Rudder loads.
8. Detailed structural layouts
9. Design of some components of wings, fuselage
10. Preparation of a detailed design report with CAD drawings.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No.	Items	Quantity	Experiment No.
1.	Drawing Board	30	4 and 5
2.	Drawing Instrument	20	4 and 5

AIRCRAFT SYSTEMS LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

1. Aircraft “Jacking Up” procedure
2. Aircraft “Levelling” procedure
3. Control System “Rigging check” procedure
4. Aircraft “Symmetry Check” procedure
5. “Flow test” to assess of filter element clogging
6. “Pressure Test” To assess hydraulic External/Internal Leakage
7. “Functional Test” to adjust operating pressure
8. “Pressure Test” procedure on fuel system components
9. “Brake Torque Load Test” on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

S.No.	Items	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,8,9,10
2.	Hydraulic Jacks (Screw Jack)	5	1,2,4,8
3.	Trestle adjustable	5	1,2,4,8
4.	Spirit Level	2	8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	1	8

AVIONICS LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

DIGITAL ELECTRONICS

1. Addition/Subtraction of binary numbers.
2. Multiplexer/Demultiplexer Circuits.
3. Encoder/Decoder Circuits.
4. Timer Circuits, Shift Registers, Binary Comparator Circuits.

MICROPROCESSORS

5. Addition and Subtraction of 8-bit and 16-bit numbers.
6. Sorting of Data in Ascending & Descending order.
7. Sum of a given series with and without carry.
8. Greatest in a given series & Multi-byte addition in BCD mode.
9. Interface programming with 4 digit 7 segment Display & Switches & LED's.
10. 16 Channel Analog to Digital Converter & Generation of Ramp, Square, Triangular wave by Digital to Analog Converter.

AVIONICS DATA BUSES

11. Study of Different Avionics Data Buses.
12. MIL-Std – 1553 Data Buses Configuration with Message transfer.
13. MIL-Std – 1553 Remote Terminal Configuration.

Total: 45

LIST OF EQUIPMENT
(for a batch of 30 students)

S.No.	Details of Equipments	Quantity	Experiment Nos.
1	Adder / Subtractor Binary bits Kit	6	1
2	Timer Kit	6	1
3	Encoder Kit	6	3
4	Decoder Kit	6	3
5	Comparator Kit	6	4
6	Multiplexer Kit	6	2
7	Demultiplexer Kit	6	2
8	Shift Registers Kit	6	4
9	Electronic Design Experimeter	6	6,7,9,10
10	Microprocessor 8085 Kit	9	5,6,7,8,9,10
11	4 Digit 7 Segment Display	3	6
12	Switches & LED's Circuit	3	6
13	16 Channel AD Converter	6	10,9
14	Digital to Analog Converter	6	10
15	Cathode Ray Oscilloscope	3	9,10
16	Regulated Power Supply (5V DC)	9	1, 2,3,4
17	MIL-Std 1553B Setup with Remote Terminal	1	12,13
18	Computers	2	11,12,13

HS1301 – COMMUNICATION AND SOFT SKILLS LABORATORY
(Common to All Branches)

L T P
1 0 3

UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS

Introductions and meetings – Talking about studies and/ or job – Expressing likes and dislikes – Describing daily routines and current activities – Talking about past states and events – Talking about future plans and intentions – Expressing preferences – Giving reasons – Expressing opinions, agreement and disagreement – Seeking and giving advice – Making suggestions.

UNIT II SPEAKING APPLICATIONS

Making an oral presentation – Preparing the presentation – Performing the presentation – Beginning – Language – Visual aids and body language – Voice – Ending – Questions – Telephone conversations – Group discussion and interview.

UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC).

UNIT IV SOFT SKILLS (1)

Preparing for and dealing with change – Motivation, goal-setting and self-esteem – Managing time and stress – Career and life planning – Team work – Leadership traits.

UNIT V SOFT SKILLS (2)

Multiple intelligences – Learning styles and personality typing – Critical and creative thinking – People, cultures and self – Intercultural communication.

REFERENCES

1. Kamalesh Sadanand, and Susheela Punitha, “Spoken English: A Foundation Course” for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008.
2. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi, Cambridge University Press, 2005.
3. Barbara Garside, Tony Garside, “Essential Telephoning in English” (Audio CD), Cambridge, Cambridge University Press, 2002.
4. Hari Mohan Prasad, Rajnish Mohan, “How to Prepare for Group Discussion and Interview” (Audio Cassette) Tata McGraw-Hill Publishing.
5. “International English Language Testing System Practice Tests”, CUP.
6. “Business English Certificate Materials”, Cambridge University Press.
7. “Understanding the TOEFL”, Educational Testing Services, Princeton, US.
8. Interactive Multimedia Programs on Managing Time and Stress.
9. Robert M. Sherfield, “Developing Soft Skills” New Delhi: Pearson Education, 4th Edition, 2009.

L: 15 P: 45 Total: 60

List of activities that are to be carried out:

(15 sessions x 3 periods = 45)

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

SEMESTER VIII

ROCKETS AND MISSILES

L T P
3 0 0

UNIT I **ROCKETS SYSTEM** **10**

Ignition system in rockets – Types of igniters – Igniter design considerations – Design consideration of liquid rocket combustion chamber, injector propellant feed lines, valves, propellant tanks outlet, helium pressurized and turbine feed systems – Propellant slash and propellant hammer – Elimination of Geysering effect in missiles – Combustion system of solid rockets.

UNIT II **AERODYNAMICS OF ROCKETS AND MISSILES** **13**

Airframe components of rockets and missiles – Forces acting on a missile while passing through atmosphere – Classification of missiles – Methods of describing aerodynamic forces and moments – Lateral aerodynamic moment – Lateral damping moment and longitudinal moment of a rocket – Lift and drag forces – Drag estimation – Body upwash and downwash in missiles – Rocket dispersion – Numerical problems.

UNIT III **ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD** **10**

One and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories – Determination of range and altitude simple approximations to burnout velocity.

UNIT IV **STAGING AND CONTROL OF ROCKETS AND MISSILES** **7**

Rocket vector control – Methods – Thrust determination – SITVC – Multistaging of rockets – Vehicle optimization – Stage separation dynamics – Separation techniques.

UNIT V **MATERIALS FOR ROCKETS AND MISSILES** **5**

Selection of materials – Special requirements of materials to perform under adverse conditions.

Total: 45

TEXT BOOKS

1. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley and Sons Inc., 1993.
2. Mathur, M. and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, 1998.

REFERENCES

1. Cornelisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W. Freeman and Co. Ltd., 1982.
2. Parket, E.R., “Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.

PROJECT WORK

(Common to all Branches)

L	T	P
0	0	6

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering back round information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed by the regulation (vide clause 10.3 of Anna University Regulations 2004 for B.E., B.Tech. programmes)

ELECTIVES FOR VII SEMESTER

VIBRATION AND AEROELASTICITY

	L	T	P
UNIT I BASIC NOTIONS	3	0	0
Simple harmonic motion – Terminologies – Newton’s Law – D’ Alembert’s principle – Energy Methods.			8
UNIT II SINGLE DEGREE OF FREEDOM SYSTEMS			12
Free vibrations – Damped vibrations – Forced vibrations with and without damping – Support excitation – Vibration measuring instruments.			
UNIT III MULTI DEGREES OF FREEDOM SYSTEMS			10
Two degrees of freedom systems – Static and Dynamic couplings vibration absorber – Principal co- ordinates – Principal modes and orthogonal condition – Eigen value problems.			
Hamilton’s principle – Lagrangean equation and application – Vibration of elastic bodies – Vibration of strings – Longitudinal, lateral and torsional vibrations.			
UNIT IV APPROXIMATE METHODS			5
Rayleigh’s and Holzer methods to find natural frequencies.			
UNIT V ELEMENTS OF AEROELASTICITY			10
Concepts – Coupling – Aero elastic instabilities and their prevention – Basic ideas on wing divergence, loss and reversal of aileron control – Flutter and its prevention.			
			Total: 45

TEXT BOOKS

1. Timoshenko, S., “Vibration Problems in Engineering”, John Wiley and Sons, 1993.
2. Fung, Y.C., “An Introduction to the Theory of Aeroelasticity”, John Wiley and Sons, 1995.

REFERENCES

1. Bisplinghoff, R.L., Ashely, H. and Hogman, R.L., “Aeroelasticity”, Addison Wesley Publication, 1983.
2. TSE, F.S., Morse, I.F. and Hunkle, R.T., “Mechanical Vibrations”, Prentice Hall, 1984.
3. Scanlan, R.H. and Rosenbaum, R., “Introduction to the Study of Aircraft Vibration and Flutter”, John Wiley and Sons, 1982.
4. Benson H.Tongue, “Principles of Vibration”, Oxford University Press, 2000.

FINITE ELEMENT METHOD

L	T	P
3	0	0

UNIT I	INTRODUCTION	4
	Review of basic analysis – Stiffness and flexibility matrix for simple cases – Governing equation and convergence criteria of finite element method.	
UNIT II	DISCRETE ELEMENTS	12
	Bar, Frame and beam elements – Application to static, dynamic and stability analysis.	
UNIT III	CONTINUUM ELEMENTS	10
	Various types of 2-D-elements – Application to plane stress, plane strain and axi-symmetric problems.	
UNIT IV	ISOPARAMETRIC ELEMENTS	10
	Applications to two and three-dimensional problems.	
UNIT V	FIELD PROBLEM	9
	Applications to other field problems like heat transfer and fluid flow.	
		Total: 45

TEXT BOOK

1. Tirupathi R. Chandrapatha and Ashok D. Belegundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall India, 2003.
2. Reddy, J.N., “An Introduction to Finite Element Method”, McGraw-Hill, 2000.

REFERENCES

1. Krishnamurthy, C.S., “Finite Element Analysis”, Tata McGraw-Hill, 2000.
2. Bathe, K.J. and Wilson, E.L., “Numerical Methods in Finite Elements Analysis”, Prentice Hall of India, 1985.

AEROENGINE MAINTENANCE AND REPAIR

L T P
3 0 0

UNIT I CLASSIFICATION OF PISTON ENGINE COMPONENTS 5

Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug details – Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.

UNIT II INSPECTIONS OF PISTON ENGINES 8

Inspection and maintenance and trouble shooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

UNIT III INSPECTIONS OF PISTON ENGINES 10

Symptoms of failure – Fault diagnostics – Case studies of different engine systems – Tools and equipment requirements for various checks and alignment during overhauling – Tools for inspection – Tools for safety and for visual inspection – Methods and instruments for non destructive testing techniques – Equipment for replacement of part and their repair – Engine testing: Engine testing procedures and schedule preparation – Online maintenance.

UNIT IV CLASSIFICATION OF JET ENGINE COMPONENTS 12

12 Types of jet engines – Principles of operation – Functions of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection and checks – Use of instruments for online maintenance – Special inspection procedures: Foreign object damage, Blade damage, etc.

Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures – Gas turbine testing procedures – Test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

UNIT V OVERHAUL PROCEDURES 10

Engine overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of gas turbine components – Trouble shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – Engine health monitoring and corrective methods.

Total: 45

TEXT BOOK

1. Kroes and Wild, "Aircraft Power plants", 7th Edition, McGraw Hill, 1994.
2. Anderson, Jr.D., "Fundamentals of Aerodynamics", McGraw-Hill, 2000.

REFERENCES

1. Turbomeca, "Gas Turbine Engines", The English Book Store, 1993.
2. United Technologies Pratt and Whitney, "The Aircraft Gas Turbine Engine and its Operation", The English Book, 1993.

THEORY OF PLATES AND SHELLS

L	T	P
3	0	0

UNIT I	CLASSICAL PLATE THEORY	3
---------------	-------------------------------	----------

Classical plate theory – Assumptions – Differential equations – Boundary conditions.

UNIT II	PLATES OF VARIOUS SHADES	15
----------------	---------------------------------	-----------

Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary Conditions – Governing equation – Solution for axi-symmetric loading – Annular plates – Plates of other shapes.

UNIT III	EIGEN VALUE ANALYSIS	8
-----------------	-----------------------------	----------

Stability and free vibration analysis of rectangular plates.

UNIT IV	APPROXIMATE METHODS	10
----------------	----------------------------	-----------

Rayleigh-Ritz, Galerkin methods – Finite difference method – Application to rectangular plates for static, free vibration and stability analysis.

UNIT V	SHELLS	9
---------------	---------------	----------

Basic concepts of shell type of structures – Membrane and bending theories for circular cylindrical shells.

Total: 45

TEXT BOOK

1. Timoshenko, S.P., Winowsky, S. and Kreger, "Theory of Plates and Shells", McGraw-Hill Book Co., 1990.
2. Timoshenko, S., Strength of Materials, Van Nostrand, 1986.

REFERENCES

1. Flugge, W., "Stresses in Shells", Springer - Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill Book Co., 1986.

ELECTIVES FOR VIII SEMESTER
COMPUTATIONAL FLUID DYNAMICS
(Common to Aeronautical and Mechanical)

L T P
3 0 0

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, momentum and energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for turbulent flow – Turbulence, kinetic and energy equations – Mathematical behavior of PDEs on CFD: Elliptic, Parabolic and hyperbolic equations.

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES 9

Methods of deriving the discretization equations – Taylor series formulation – Finite difference method – Control volume formulation – Spectral method.

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method and Alternating direction implicit method.

UNIT III HEAT CONDUCTION 9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation – Source term linearization – Incorporating boundary conditions – Finite volume formulations for two and three dimensional conduction problems.

UNIT IV CONVECTION AND DIFFUSION 9

Finite volume formulation of steady state one-dimensional convection and diffusion problems – Central, upwind, hybrid and power-law schemes – Discretization equations for two dimensional convection and diffusion.

UNIT V CALCULATION OF FLOW FIELD 9

Representation of the pressure – Gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure – Correction equation, simple algorithm and its variants – Turbulence models: mixing length model and Two equation (k- ϵ) models.

Total: 45

TEXT BOOKS

1. Versteeg, H.K, and Malalasekera, W., “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Longman, 1998.
2. Ghoshdastidar, P.S., "Computer Simulation of Flow and Heat Transfer", Tata McGraw-Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V., “Numerical Heat Transfer and Fluid Flow”, McGraw-Hill, 2004.
2. Muralidhar, K. and Sundarajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, 1995.
3. Bose, T.K., “Numerical Fluid Dynamics”, Narosa Publishing House, 1997.
4. Muralidhar, K. and Biswas, “Advanced Engineering Fluid Mechanics”, Narosa Publishing House, 1996.
5. Anderson, J.D., “Computational Fluid Dynamics – The Basics with Applications”, 1995.

AIR TRANSPORTATION AND AIRCRAFT MAINTENANCE

L T P
3 0 0

UNIT I INTRODUCTION

8

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft – Airport: airline management and organisation – Levels of management – Functions of management – Principles of organisation planning the organisation – Chart, staff departments and line departments.

UNIT II AIRLINE ECONOMICS

10

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic and political factors on routes and route selection.

FLEET PLANNING: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and capital acquisition – Valuation and depreciation – Budgeting and cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT III PRINCIPLES OF AIRLINES SCHEDULING

10

Equipment maintenance, flight operations and crew scheduling – Ground operations and facility limitations – Equipments and types of schedule – Hub and spoke scheduling – Advantages / disadvantages – Preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV AIRCRAFT RELIABILITY

9

Aircraft reliability – The maintenance schedule and its determinations – Condition monitoring maintenance – Extended range operations (EROPS) and (ETOPS) – Ageing aircraft maintenance production.

UNIT V TECHNOLOGY IN AIRCRAFT MAINTENANCE

8

Airlines scheduling (with reference to engineering) – Product support and spares – Maintenance sharing – Equipments and tools for aircraft maintenance – Aircraft weight control – Budgetary control.

On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage is monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

Total : 45

TEXT BOOKS

1. Kroes, Watkins, Delp, “Aircraft Maintenance and Repair”, McGraw Hill, New York, 1992.
2. Larry Reithmeir, “Aircraft Repair Manual”, Palamar Books, Marquette, 1992.

REFERENCES

1. Fedric J.H., “Airport Management”, English Book House, New Delhi.
2. Friend, C.H., “Aircraft Maintenance Management”, English Book House, New Delhi.
3. Wilson and Bryon, “Air Transportation”, English Book House, New Delhi.
4. Philip Lockin D, “Economics of Transportation”, English Book House, New Delhi.
5. “Indian Aircraft manual”, DGGA, English Book House, New Delhi.
6. Alexander T. Wells, “Air Transportation”, Wadsworth Publishing Company, 1993.

AIR TRAFFIC CONTROL AND AERODROME DESIGN

L T P
3 0 0

UNIT I BASIC CONCEPTS 9

Objectives of ATS - Parts of ATC service – Scope and provision of ATCs – VFR and IFR operations – Classification of ATS air spaces – Various kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

UNIT II AIR TRAFFIC SERVICES 9

Area control service – Assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance – ATC clearances – Flight plans – position report

UNIT III FLIGHT INFORMATION ALERTING SERVICES, COORDINATION, EMERGENCY PROCEDURES AND RULES OF THE AIR 10

Radar service – Basic radar terminology – Identification procedures using primary / secondary radar – Performance checks – Use of radar in area and approach control services – Assurance control and co-ordination between radar / non radar control – Emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

UNIT IV AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data – Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway and physical Characteristics: length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – Obstacles restriction.

UNIT V VISUAL AIDS FOR NAVIGATION, VISUAL AIDS FOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES 8

Visual aids for navigation wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings – General requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI and PAPI – Visual aids for denoting obstacles: object to be marked and lighter – Emergency and other services.

Total: 45

TEXT BOOK

1. AIP (India) Vol. I and II, “The English Book Store”, 17-1, Connaught Circus.

REFERENCES

1. “Aircraft Manual (India) Volume I”, Latest Edition, The English Book Store, 17-1, Connaught Circus.
2. “PANS – RAC – ICAO DOC 4444”, Latest Edition, The English Book Store, 17-1, Connaught Circus.

PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

L	T	P
3	0	0

UNIT I HUMAN VALUES 10

Morals, values and ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of Professional Roles – Theories about right action – Self-interest – Customs and religion – Uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The Three Mile Island and Chernobyl case studies

Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as managers – Consulting engineers – Engineers as expert witnesses and advisors – Moral leadership – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Total: 45

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, 1996.
2. Govindarajan, M., Natarajan, S. and Senthil Kumar, V.S., "Engineering Ethics", Prentice Hall of India, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, 2004.
2. John R. Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G. Seebauer and Robert L. Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.